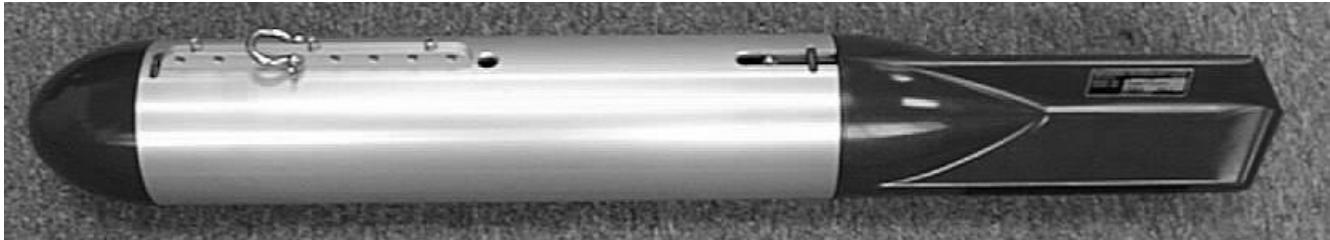


Setting up your SportScan® for use



Unpack your SportScan and check for the following parts:

1. SportScan Sidescan Sonar Towfish
2. Shackle
3. Cable
4. Floppy Disk containing WIN881SS Software
5. Software User's Manual

*Ballast weights are not included

Connecting the cable to the SportScan

1. The rear section of the SportScan houses the sonar transducers and the electronics. To remove this section from the Aluminum ballast housing tube it is necessary to extract the plastic retaining snap ring (Fig.1). This is best accomplished by using a pair of needle nose pliers.
2. The rear section may now be slid out and away from the housing tube (Fig.2).
3. Apply a small amount of silicon grease to the rubber part of the male pins on the electronics bulkhead.
4. Check the orientation of the two connector halves and carefully but firmly push them together. A retaining strap is molded into the female connector. Slip this over and behind the male connector for security (Fig.3).
5. Install the rear section back into the Ballast housing, taking care to fit the cable into the slot provided. Thread the plastic snap ring back into the groove completely (Fig.4).
6. Attach the cable thimble to the Aluminum housing using the shackle provided (Fig.5).

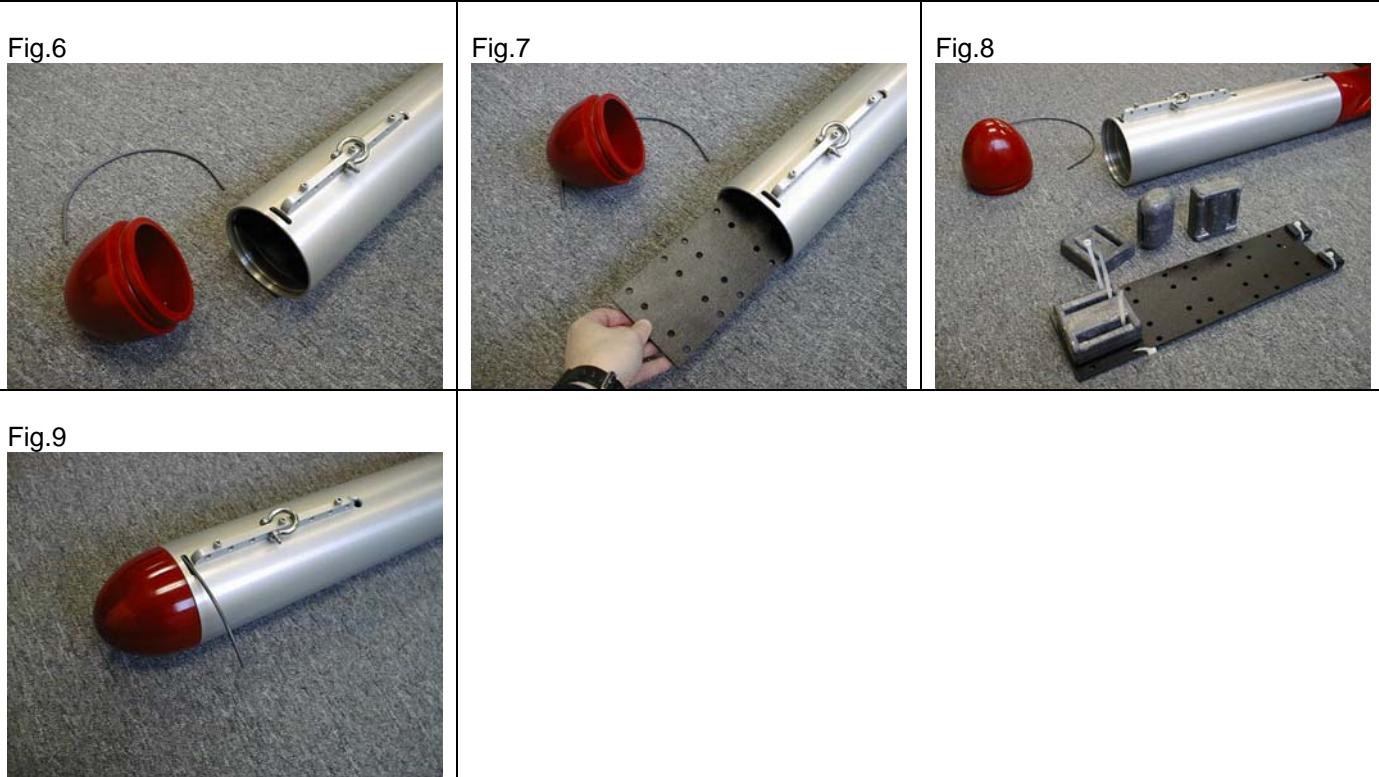
<p>Fig.1</p> 	<p>Fig.2</p> 	<p>Fig.3</p> 
<p>Fig.4</p> 	<p>Fig.5</p> 	

Installing Ballast

1. Remove the nose cone of the SportScan (Fig.6).
2. Extract the ballast mounting plate from inside the ballast housing (Fig.7). Make a note of the orientation.
3. The SportScan is designed to use conventional 3lb lead diving weights as ballast* (Fig.8).
4. Add at least 15-20lbs of ballast as far forward and as low as possible, securing the weights using tie-wraps. Adding more weight will allow the SportScan to be towed at a greater depth.

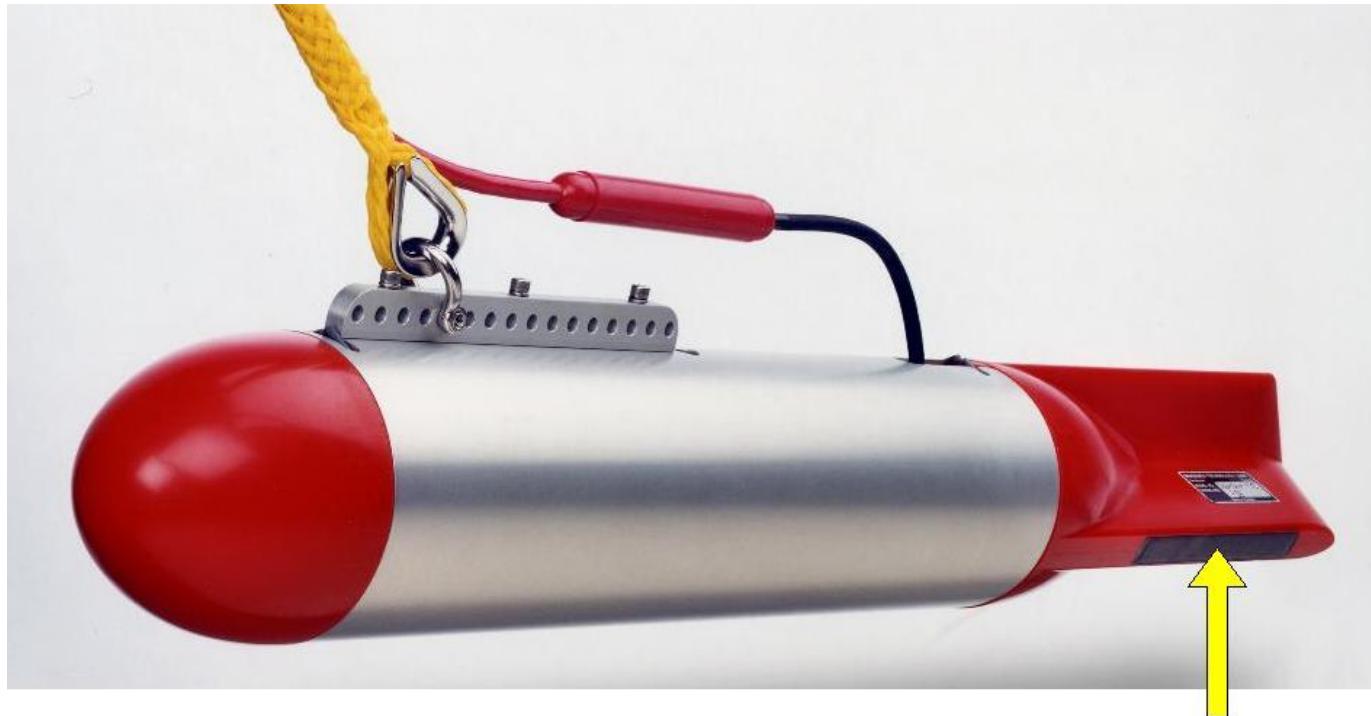
CAUTION: MAXIMUM DEPTH RATING IS 100 FEET!

5. Slide the ballast plate back into the housing, reinstall the nose cone, and fit the plastic snap ring (fig.9).



Trimming the SportScan by adjusting the tow shackle position

- Immerse the SportScan in still water, and adjust the shackle position so that the SportScan lies parallel to the water surface (ensure that no air is trapped in the ballast housing, as this will give a false indication). If the SportScan wanders while being towed, adjust the shackle position so that the towfish is slightly nose heavy.



WARNING: AVOID IMPACT TO THIS AREA

IMAGENEX SPORTSCAN

APPLICATIONS:

- Underwater Archaeology
- Sunken Timber Recovery
- Search & Recovery
- Surveying
- Law Enforcement Work
- Scientific Research
- Environmental Survey

FEATURES:

- Very user friendly
- Lightweight and extremely portable
- Inexpensive
- 23 m (75') tow cable included
- High resolution
- Up to 240 m (800') total coverage
- GPS interface
- Speed correction
- Height and length measurements
- 4 user selectable colour tables
- XTF Conversion program (optional)

The Imagenex SportScan is an affordable dual channel, high-resolution, digital side-scan sonar geared toward the sport diving market. Operate the SportScan directly from your laptop or desktop PC. All that is needed is a 12 VDC power source. Connect a GPS receiver for latitude and longitude coordinates.

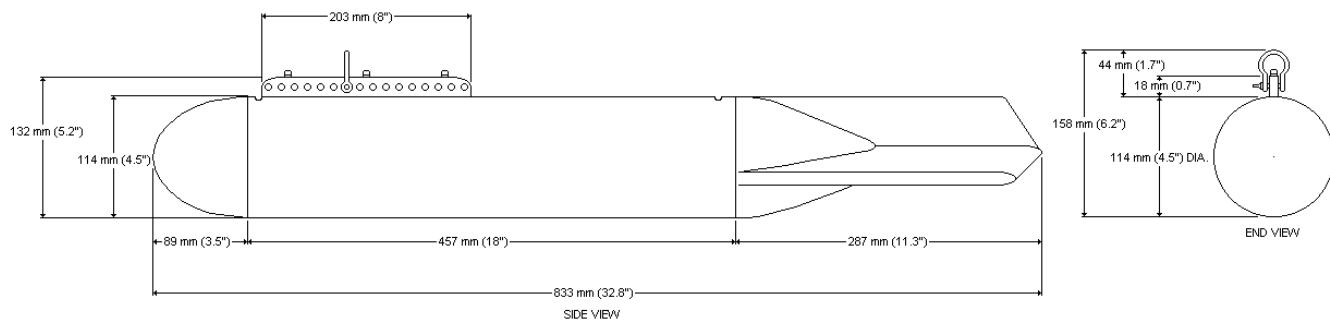


HARDWARE SPECIFICATIONS:

FREQUENCY	330 kHz or 330 / 800 kHz
TRANSDUCER	One transducer per side, tilted down 20°
TRANSDUCER BEAM WIDTH	330 kHz: 1.8° x 60° 800 kHz: 0.7° x 30°
RANGE RESOLUTION	Both sides displayed: Range scale ÷ 250 Single side displayed: Range scale ÷ 500
MAX. OPERATING DEPTH	30 m (100')
MAX. CABLE LENGTH	60 m (200')
INTERFACE	RS-232 serial interface @ 115.2 kbps
CONNECTOR	Wet mateable (Impulse LPMBH-4-MP)
POWER SUPPLY	10 – 16 VDC at 300 mA max.
DIMENSIONS	114 mm (4.5") diameter x 833 mm (32.8") length
WEIGHT: In Air	4.5 kg (10 lbs) not including ballast
In Water	1.2 kg (2.7 lbs)
BALLAST	Standard diver belt weights (readily available at dive shops)
MATERIALS	Polyurethane & 6061-T6 Aluminum
FINISH	Clear anodized

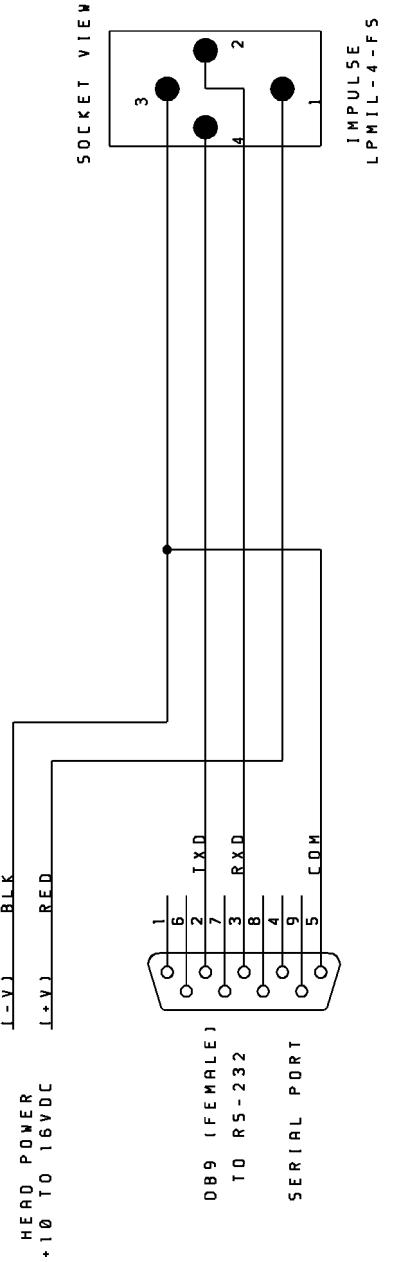
SOFTWARE SPECIFICATIONS:	Win881ss.exe
WINDOWS™ OPERATING SYSTEM	Windows™ 95, 98, Me, NT*, 2000*, XP*, Vista*
MODES	Side Scan
RANGE SCALES	15 m, 30 m, 60 m, 90 m, and 120 m (50', 100', 200', 300', and 400')
FILE FORMAT	(filename).81s
GPS INPUT (4800, N, 8, 1) NMEA 0183 FORMATS:	GLL, GGA, VTG, RMC
RECOMMENDED MINIMUM COMPUTER REQUIREMENTS:	100 MHz Pentium 16 MB RAM 1 GB Hard Disk 800 x 600 x 256 colour graphics

* Requires Win881ss.exe v2.00 or higher (Free upgrade available for older versions – Contact Imagenex)

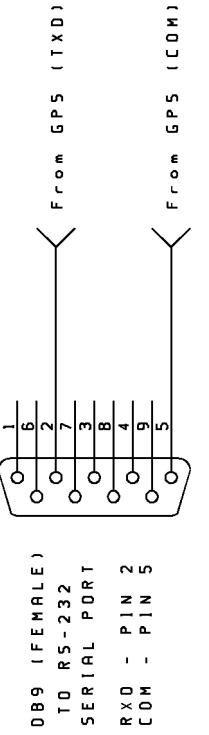


ORDERING INFORMATION:		
30 m unit w / 23 m SportScan tow cable	Standard	881-000-150
330 / 800 kHz	Option	-005
60 m (200') SportScan tow cable	Option	-017
XTF Converter (Imagenex .81s to XTF)	Option	-019

Product and company names listed are trademarks or trade names of their respective companies.



IMAGENEX Technology Corp.	
SPORTSCAN TOW CABLE	
Size A	Document Number B81-200-116
Date: February 22, 2001	Sheet 1 of 1
3	2
4	1



SET GPS RECEIVER OUTPUT AS FOLLOWS:

4800 Bits Per Second
8 Data Bits
No Parity
1 Stop Bit

IMAGENEX Technology Corp.

Title RS-232 PIN-OUT FOR GPS INPUT

Size	Document Number	Rev
A	881-200-121	B1
Date:	June 4, 2001 Sheet 1 of 1	

Model 881 SPORTSCAN Digital Sidescan Sonar

Frequently Asked Questions

What can I use to power the SportScan?

The SportScan requires a DC voltage between 10 and 16 volts for proper operation (+12VDC @ 0.5A max.). A 12 volt lab power supply could be used, or you can connect to the 12VDC wiring on your boat. A 12 volt car battery could also be used. The RED wire from the SportScan cable should be connected to the Positive terminal and the BLACK wire should be connected to the Negative terminal.

How deep can I tow the SportScan?

The maximum allowable depth for the SportScan towfish is 100 feet (30 meters).

Will the Win881SS program operate using Windows NT, 2000 and XP?

Yes, Win881SS (v2.00 and higher) will operate using Windows 95/98/Me/NT/2000 and XP. Versions below v2.00 will only operate on Windows 95/98 and Me.

What do I do when I see the message “Win881SS requires 256 Color Mode!”

Win881SS (v3.00 and lower) must operate in the 256 color mode (8 Bits). From the Start menu, highlight ‘Settings’ and click on ‘Control Panel’. Double-click the ‘Display’ icon to invoke the Display Properties page. Click the ‘Settings’ tab and then select ‘256 Colors’ from the Colors drop down list. Press OK.

How do I connect the SportScan and a GPS receiver to my laptop if there is only one or no serial ports?

You can add serial ports to your laptop by using the PCMCIA slots or the USB port. There are many PCMCIA cards available that provide an RS-232 interface to the computer. One example is the Model 232PCC from B&B Electronics (www.bb-elec.com). This card provides a DB-9 male connector which the SportScan cable will directly plug into. B&B also makes the Model US1000A and Model UC232A USB to RS-232 Converters and IOGEAR (www.iogear.com) makes the Model G-UC232A. All of these devices come with driver files which allows Windows to configure the device as an additional COM port.

Frequently Asked Questions (con't)

Why does my GPS work with my NAV program but not with Win881SS?

The serial port used for the GPS input must not be in use by another program when invoking Win881SS (only one program can have access to any one serial port). Ensure that the GPS receiver unit is setup to output \$GPGLL, \$GPGGA or \$GPRMA messages at 4800 bps, No Parity, 8 Data Bits and 1 Stop Bit.

Why does the “No Data at COM1” message always flash when using my Toshiba Laptop computer?

The serial ports on Toshiba laptops behave differently than on other laptops. From the Start menu, highlight ‘Settings’ and click on ‘Control Panel’. Double-click the ‘System’ icon to invoke the System Properties page. Click the ‘Device Manager’ tab and Double-click the ‘Ports (COM & LPT)’ setting. Double-click ‘Communications Port (COM1)’ to invoke the Communications Port (COM1) Properties page. Click the ‘Port Settings’ tab and enter the following settings:

Bits per second = 115200
Data bits = 8
Parity = None
Stop bits = 1
Flow control = Xon / Xoff

Click the ‘Advanced...’ button to invoke the Advanced Port Settings page. Set the ‘Receive Buffer’ to the Low(1) setting (left-most position) and press the ‘OK’ button. You can also try disabling the ‘Use FIFO buffers’ check box.

Another solution is to use a USB to RS-232 serial adapter (like the Model G-UC232A from www.iogear.com) rather than the dedicated serial port on the rear panel of the laptop.

Frequently Asked Questions (con't)

How far off the bottom should I tow the SportScan?

The SportScan altitude should be 10 to 20 percent of the operating range above the bottom. For example, if the operating range is set to 90 meters, the SportScan should be 9 to 18 meters above the bottom (remember the 30 meter maximum depth limit!). When the bottom is nearly flat, you can tow close to the bottom. When the bottom is not flat, tow at a higher altitude.

Note: If you are towing in unknown area where there could be obstructions, it is best to tow the SportScan just beneath the surface to avoid collisions with unknown objects.

Can the SportScan be damaged in any way by operating it out of the water?

No, the SportScan can not be damaged by operating it in air. In fact, all units receive a 24 hour burn-in test (in air) before shipping. However, if you do operate it in air (i.e. on the deck of your boat), ensure that the unit is not sitting in direct sunlight for extended periods of time.

How much hard drive space is required for saving the .81S SportScan data files?

Storage consumption is typically about 10–15MB per hour.

How fast can I tow the SportScan?

The best images are developed when towing at about 2-3 knots. The slower the tow speed, the more echoes you will get from any one target and the better the sonar image will appear. Depending on the type of boat you are using, you might need to run as slow as the boat will travel.

Frequently Asked Questions (con't)

What is Speed Correction?

Speed Correction is a process which adds or removes data lines from the sonar image in order to produce a 1:1 aspect ratio on the screen (so a square target appears square and not rectangular). The SportScan transmits and receives data at a fixed rate depending on operating range. If the tow speed increases, the distance traveled is greater, but because the rate remains constant, the sonar image will be compressed in time (along track). Speed Correction will compensate for this compression by adding lines in the data at the appropriate places.

Using the speed from your GPS receiver will give the best results as it will constantly update in real time. Using manual speed entry will suffice if a GPS receiver is not available.

What Gain setting should I use?

The Gain setting is like a volume control on a stereo, the higher the number, the ‘louder’ the image will be. The type of seafloor beneath you will determine the gain setting that you should use. When the Color Table is set to ‘Color’, the sidescan data will be displayed using blue, green, orange, yellow, white and red colors. Weak returns will be blue and strong returns will be red. A muddy bottom will be displayed in blue with a Gain of less than about 16dB. Whereas, a rocky bottom might be red at the same Gain setting. In this case, you should lower the gain to maybe less than 6dB. The key is to set the Gain such that only very strong returns show up in the red color. If the Gain is set too high, most of the image will be saturated with red which limits the dynamic range of the system, meaning you won’t be able to ‘see’ the difference between a target lying on the bottom and the bottom itself. Normally, the Gain should be set anywhere between 6dB and 20dB (but please experiment). Once the gain is set, using the ‘Grey’ Color Table is useful for seeing different shapes on the bottom and shadows will be more apparent.

Frequently Asked Questions (con't)

When collecting sidescan data, why does the “No Data at COM1” message flash once and a while when using a Laptop computer?

If any of the laptop’s Power Management settings are enabled (i.e. maximum battery life, hard drive shut down, etc...), the laptop has to monitor these activities at the same time that the real time sonar data is being acquired. This can cause the Win881ss.exe program to miss data from the SportScan Head and the message might flash. Ensure that all Power Management settings are disabled in the BIOS settings and through the Control Panel ‘Power’ settings.

Why does the SportScan image display stop scrolling when I connect the GPS?

If the GPS speed is 0 knots and Speed Correction is enabled, the display will not scroll. Disable Speed Correction while the GPS coordinates are not changing.

**MODEL 881 SPORTSCAN
Single or Dual Frequency Digital Sidescan Sonar****Software User's Manual****WIN881SS.EXE: VERSION 3.07 (Win 9x/NT/2000/XP/Vista)****OVERVIEW**

WIN881SS is a Windows program that controls, displays and records data from the single or dual frequency Model 881 SportScan. The program uses an RS-232 COM port (115200,N,8,1) for communication to/from the SportScan. A second RS-232 COM port (4800,N,8,1 or 9600,N,8,1) can be used for receiving Lat/Lng coordinates and ships speed and heading from any GPS receiver. The SportScan can be operated at different ranges and gains. The Windows display mode must be at least 800 x 600 pixels with small fonts selected.

SCREEN LAYOUT

The main screen of WIN881SS is the sonar data window. The sonar data from the port and starboard channels of the SportScan pan across the screen from right to left to generate a 'picture' of the seafloor. Below the sonar window there are controls for changing the Range, Gain and Current Sidescan Channel. Other items include readouts for date/time, Lat/Lng coordinates, ships speed and heading, target cursor range, current frequency and a control for displaying real time data from the SportScan or playback data from a file. The Main Menu has various features including switches for operating frequency, sonar data color, target length and height measurement, speed correction (from GPS or manual) and a pop-up zoom window.

OPERATION

To operate the SportScan, ensure that the DB9 connector from the tow cable is connected to the RS-232 serial port on your PC. Apply nominal +12VDC (+10 to +16VDC) to the 2 power wires (+V to RED, -V to BLACK) using a DC power supply capable of supplying a current of 0.5 Amps. Run the program WIN881SS.EXE and select the button DATA FROM 'HEAD' on the lower left-hand side of the display. Ensure that the correct COM port is selected via the Com Ports Menu.

MAIN MENU

File Menu

Data From...	to display real time data from the connected SportScan Head or previously recorded data from a SportScan File.
Record Start (Stop)...	opens a File Name Dialog Box so the user can enter a filename for logging SportScan data (ping by ping) complete with date/time and Lat/Lng coordinates. The file extension is always '.81S'. The filename and current size (kbytes) of the file are displayed at the top of the screen. File recording continues until Record Stop is selected. Available only when DATA FROM ' HEAD ' is active.
Playback...	opens a File Name Dialog Box so the user can select and playback a previously recorded '.81S' SportScan file. Available only when DATA FROM ' FILE ' is active.
Copy Start (Stop)...	opens a File Name Dialog Box so the user can enter a filename to generate a new ' 81S ' file that can be used for making smaller data files from large pre-recorded SportScan files. The filename and current size (kbytes) of the file are displayed at the top of the screen. File copying continues until Copy Stop is selected. Available only when DATA FROM ' FILE ' is active.
Save Screen...	opens a File Name Dialog Box so the user can enter a filename for saving the screen as a ' BMP ' Windows BITMAP file.
Exit	writes current configuration to file (WIN881SS.INI), closes the program and exits to Windows.

Color Table Menu

Color	color table used for mapping the echo data amplitude to a color for display. Color depth is 107 colors ranging from Black (lowest level) through Blue, Green, Orange, Yellow, White and Red (highest level).
Grey	107 shades of grey (White on Black).
Reverse Grey	107 shades of grey (Black on White).
Brown	107 shades of brown (Brown on Black).

MAIN MENU (con't)

Com Ports Menu

SportScan Head	to select the serial communications port (COM1-COM32) for communicating with the SportScan. Ports that are already used or unavailable are not displayed. All communication through this port is at 115200 bits per second, No Parity, 8 Data Bits and 1 Stop Bit.
GPS Input	to select the serial communications port (COM1-COM32) for receiving Lat/Lng ships position coordinates and ships speed and heading information from a GPS receiver. For ships position, this port can accept the NMEA 0183 \$GPGLL string, the \$GPGGA string or the \$GPRMC string. If Speed from GPS is selected in the Misc Menu , and GLL or GGA is selected, the \$GPVTG string will be used for the speed and heading displays. If RMC is selected, the speed and heading information from the \$GPRMC string is used. All communication through this port is at 4800,N,8,1. The baud rate can be changed to 9600,N,8,1 by setting GPSBaudRate=1 in the WIN881SS.INI file. The default is GPSBaudRate=0 for 4800,N,8,1. If the program detects only one available COM port (i.e. on a laptop computer), this port will be reserved for communications with the SportScan only and GPS Input will not be available.
	As default on most computers, COM1/COM3 share IRQ4 (interrupt request #4) and COM2/COM4 share IRQ3. Ensure that the COM port you select for GPS Input does not share its IRQ with the SportScan COM port. This could cause the program to hang up!
GLL	to use Lat/Lng coordinates from the \$GPGLL string. \$GPVTG is used for speed/heading.
GGA	to use Lat/Lng coordinates from the \$GPGGA string. \$GPVTG is used for speed/heading.
RMC	to use Lat/Lng coordinates and speed/heading information from the \$GPRMC string

MAIN MENU (con't)

Misc Menu

Units	to change the units of measurement from Meters to Feet.
Grid	to display the range division lines on the sonar display.
Clear Screen Now	to clear all echo data from the sonar display.
Diagnostics	displays the Diagnostics pop-up window. This window displays the header information from the SportScan.
Zoom	displays a x3 pixel zoom pop-up window. A rectangular area about the cursor is displayed in this window. Click the left mouse button once to capture the zoom window contents. Click again to release the capture.
Manual Speed	used to enter the towing speed of the boat (in knots) if GPS speed is not available. The speed is needed in order to perform Speed Correction on the sonar data. Not available if Speed from GPS is selected.
Speed from GPS	used for sonar data Speed Correction. Select this function if the \$GPRMC or \$GPVTG strings are available from your GPS receiver. If none of these strings are available, enter the tow speed using the Manual Speed entry.
Speed Correction	use this function to plot the SportScan data with a 1:1 aspect ratio. The displayed along track distance will be the same as the slant range echo distance. Circular targets will appear circular.
Along Track Marks	used to display the along track tick marks on the sonar data display. If Speed Correction is selected, the distance between the along track marks will be the same number of pixels as the distance between the range division grid lines.

MAIN MENU (con't)

Options Menu

Target Calculations:

Target Length

to measure the distance between two targets. Position the target cursor anywhere on the sonar image display and press the right mouse button. A second target cursor is displayed with a rubber-banded line drawn between the two cursors. The distance between the two cursors is displayed in meters (or feet). Press the right mouse button again to remove the second cursor.

Target Height

to measure the approximate height off the bottom of a target (assuming a flat bottom). When selected, the cursor will display '**Target Height - Click on Target**'. At this point, position the target cursor on the target of interest and press the left mouse button. A vertical rubber-banded line is drawn from the cursor position to the beginning of the transmit pulse with the message '**Click on Bottom Return**'. Position the cursor so that the end of the rubber-banded line is at the beginning of the bottom return (the end of the water column) and press the left mouse button again. The message '**Click on Shadow Start**' is now displayed. Position the cursor at the beginning of the shadow that the target has cast and press the left mouse button. The message '**Shadow End – Height = ???M**' is displayed. Move the cursor to the end of the shadow to display the height measurement. Press the left mouse button again to begin a new measurement.

Frequency

to select the operating frequency (High or Low) for the connected Dual Frequency SportScan. The high frequency selection will produce a higher resolution picture, but overall range will be limited to about 60 meters (200 feet) per side. If a Single Frequency SportScan is connected, the high frequency selection is not available.

MAIN MENU (con't)

Channel Balance... allows the user to balance the port and starboard channels during real time operations (DATA FROM 'HEAD'). A maximum of 6dB between channels can be obtained. The value for each channel is displayed on the main screen below the Hold Button. The channel balance number is saved in the '.81S' record file as well as in the WIN881SS.INI file.

About Menu

About... displays an about box showing the software version and date of this program. Contact information for Imagenex Technology Corp. is also displayed.

ON SCREEN SWITCHES

DATA FROM 'HEAD'	to display real time data from the connected SportScan Head.
DATA FROM 'FILE'	to display data from a previously recorded ' .81S ' SportScan file.
Hold	to hold or freeze the display.
Range	to change the sonar operating range. Available ranges are: 15m (50ft) 30m (100ft) 60m (200ft) 90m (300ft) 120m (400ft)
	Available only when DATA FROM ' HEAD ' is active.
Gain	to change the gain of the SportScan receiver amplifiers. Increase to get higher return levels, decrease to get lower return levels. The Gain can be adjusted from 0dB to 40dB in 1dB increments. Available only when DATA FROM ' HEAD ' is active.
Channel	to display the data from the Port side channel, Starboard side channel or both channels.
TrackBar	to re-position the file pointer during file playback. Available only when DATA FROM ' FILE ' is active.
REC Pause	to suspend the recording of SportScan data while still allowing the user to view real time data. When paused, a flashing red message is displayed to remind the user that data is not being recorded. Available only when DATA FROM ' HEAD ' is active and a file is open for recording.
Plot Spd	to increase or decrease the file playback speed. Available only when DATA FROM ' FILE ' is active.

KEYBOARD SWITCHES

The following switches are selected via keyboard entry (case insensitive):

G	to change the Gain of the SportScan receiver amplifiers. When the 'G' key is pressed, the Key Command Entry Box (above the Lat/Lng window) displays the prompt: Gain: ? dB . Type in a valid gain number (0-40) and press <Enter> to change to the new gain value. If the entered gain is not valid or the <Esc> key is pressed, the current gain will be used. Available only when DATA FROM ' HEAD ' is active.
H	to hold or freeze the display.
R	to change the operating range of the SportScan. When the 'R' key is pressed, the Key Command Entry Box is displayed with the following prompt: Range: ? M (meters) or Range: ? FT (feet). Type in a valid range number: 15(50), 30(100), 60(200), 90(300) or 120(400) in meters or (feet) using the numeric keys and then press <Enter> to change to the new range. If the entered range is not valid or the <Esc> key is pressed, the current range will be used. Available only when DATA FROM ' HEAD ' is active.
P	to pause or resume recording. Available only when DATA FROM ' HEAD ' is active and a file is open for recording.
Arrow Keys	the arrow keys can be used to fine tune the position of the target cursor.

MESSAGES

No Data at COM?	- no power to the SportScan Head - cable not connected - SportScan COM port set to the wrong port number
Lat/Lng 'N/A'	- GPS receiver output not connected to serial port - GPS receiver is not sending data - GPS receiver not set for 4800,N,8,1 - GPS Input COM port set to the wrong port number - GPS receiver not sending the \$GPGLL, \$GPGGA or \$GPRMC NMEA 0183 message strings

DATA STORAGE FILE FORMAT (.81S)

When recording the SportScan data to a **.81S** file, the following bytes are appended and saved to the file every ping:

Note: V6 SportScans output 400 data points in total (200 points per side)
 V7 SportScans output 500 data points in total (250 points per side)

Byte #	V6 SportScan Byte Description
0 to 99	File Header (100 Bytes)
100 to 111	Sonar Return Data Header (12 Bytes)
112 to 511	Sonar Return Echo Data (400 Bytes)
512	Sonar Return Termination Byte (1 Byte, always 0xFC)
513 TO 637	Zero Fill (125 Bytes)
638 to 639	Pointer To Previous Ping The last 2 bytes of this ping contain a 16-Bit number that is the sum of the number of bytes for this ping and the number of bytes for the previous ping. This number can be used for reverse playback synchronization. Number of bytes to previous ping = ((Byte 638)<<8) (Byte 639)

Byte #	V7 SportScan Byte Description
0 to 99	File Header (100 Bytes)
100 to 111	Sonar Return Data Header (12 Bytes)
112 to 611	Sonar Return Echo Data (500 Bytes)
612	Sonar Return Termination Byte (1 Byte, always 0xFC)
613 TO 637	Zero Fill (25 Bytes)
638 to 639	Pointer To Previous Ping The last 2 bytes of this ping contain a 16-Bit number that is the sum of the number of bytes for this ping and the number of bytes for the previous ping. This number can be used for reverse playback synchronization. Number of bytes to previous ping = ((Byte 638)<<8) (Byte 639)

FILE HEADER

Bytes 0 through 99 contain the following **File Header** information:

- 0 **ASCII '8'**
- 1 **ASCII '1'**
- 2 **ASCII 'S'**

DATA STORAGE FILE FORMAT (.81S) (con't)

3 **nToReadIndex** - Index for Number of Data Bytes
3 = 400 Data Bytes for V6 SportScans,
 500 Data Bytes for V7 SportScans

4-5 **Total Bytes** - number of bytes that are written to the disk for this ping

Byte 4										Byte 5									
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	640			

6-7 **nToRead** - Number of Bytes from the SportScan

Byte 6										Byte 7									
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	413 for V6, 513 for V7			

8-19 **Date** - null terminated date string (12 bytes)
"DD-MMM-YYYY"

20-28 **Time** - null terminated time string (9 bytes)
"HH:MM:SS"

29-36 **Reserved** - always 0

37 **Reserved** – always 16

38 **Sidescan Channel**

1 = Stbd

2 = Port

3 = Both

39 **Gain**

0 to 40 in 1 dB increments

40-42 **Reserved** – always 0

43 **Reserved** – always 5

44 **Reserved** – always 9

45 **Reserved** – always 100

DATA STORAGE FILE FORMAT (.81S) (con't)

46 **Reserved** – always 0

47-58 **GPS Ships Position Latitude** – text string (12 bytes)
“**_dd.mm.hxx_N**”
dd = Degrees
mm = Minutes
xxx = Decimal Minutes
_ = Space
N = North or S = South

59-70 **GPS Ships Position Longitude** – text string (12 bytes)
“**ddd.mm.hxx_E**”
ddd = Degrees
mm = Minutes
xxx = Decimal Minutes
_ = Space
E = East or W = West

71-72 **Repetition Rate** – Time between pings

Byte 71								Byte 72							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Repetition Rate (ms)															

73 **GPS Ships Speed**
Speed = (Byte 73)/10 in knots

74-75 **GPS Ships Heading**

Byte 74								Byte 75							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Heading * 10 (in degrees)															

76 **Operating Frequency**
0 = Low Frequency
1 = High Frequency

DATA STORAGE FILE FORMAT (.81S) (con't)

77 **Channel Balance**

Byte 77							
7	6	5	4	3	2	1	0
V	Channel Balance (0 to 60)						

If V = 0, use Channel Balance of 30 = 0dB for both channels

If V = 1, Channel Balance:

$$\text{Stbd Gain} = [(\text{Byte 77} \& 0x7F) - 30]/10 \text{ in dB}$$

$$\text{Port Gain} = -[(\text{Byte 77} \& 0x7F) - 30]/10 \text{ in dB}$$

78 **WIN881SS RecordingVersion**

0 = v2.01 and lower

1 = v3.00 and higher (for V7 SportScans)

79-99 **Reserved** - always 0

DATA STORAGE FILE FORMAT (.81S) (con't)

SONAR RETURN DATA HEADER

Bytes 100 through 111 contain the following **Sonar Return Data Header** information:

- 100 **ASCII 'T'**
- 101 **ASCII 'G' or ASCII 'H' if V7 SportScan**
- 102 **ASCII 'X'**
- 103 **Head ID** – always 0x10
- 104 **Serial Status**
 - Bit 0 - 0 = V6 (or lower SportScan), 1 = V7 SportScan
 - Bit 1 - 0
 - Bit 2 - 0
 - Bit 3 - 0
 - Bit 4 - 0
 - Bit 5 - 0
 - Bit 6 - 1 = Switches Accepted
 - Bit 7 - 1 = Character Overrun
- 105 **SportScan Type**
 - 0 = Single Frequency
 - 1 = Dual Frequency
- 106 **Sidescan Channel**
 - 1 = Starboard
 - 2 = Port
 - 3 = Both
- 107 **Range**
 - 15, 30, 60, 90 or 120 meters
- 108 **Reserved** - always 0
- 109 **Reserved** – always 0

DATA STORAGE FILE FORMAT (.81S) (con't)

110 - 111 Data Bytes

Number of Data Bytes returned from the SportScan head

V6: Data Bytes = 412 (Header included)

V7: Data Bytes = 500 (Header not included)

Data Bytes (LO), Data Bytes (HI)

Byte 110								Byte 111							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Data Bytes (LO)								0	Data Bytes (HI)						

Data Bytes High Byte = (Byte 111 & 0x7E)>>1

Data Bytes Low Byte = [((Byte 111 & 0x01)<<7) | (Byte 110 & 0x7F)]

Data Bytes = (Data Bytes High Byte<<8) | Data Bytes Low Byte

SONAR RETURN ECHO DATA (example for IGX mode – V6 SportScans)

Bytes 112 through 511 contain the following **Sonar Return Echo Data** information:

If Byte 106 = 1 (Stbd) or 2 (Port), there are 400 range bytes starting at range 0 (Byte 112), ending at range 399 (Byte 511)

If Byte 106 = 3 (Both), there are 200 range bytes per channel. The range bytes alternate from channel to channel.

i.e.

Stbd[0] = Byte 112

Port[0] = Byte 113

Stbd[1] = Byte 114

Port[1] = Byte 115

.

.

Stbd[199] = Byte 510

Port[199] = Byte 511

The sonar data intensity level varies from 0 to 127.

Byte 512 **Termination Byte** - always 0xFC

DATA STORAGE FILE FORMAT (.81S) (con't)

SONAR RETURN ECHO DATA (example for IHX mode – V7 SportScans)

Bytes 112 through 611 contain the following **Sonar Return Echo Data** information:

If Byte 106 = 1 (Stbd) or 2 (Port), there are 500 range bytes starting at range 0 (Byte 112), ending at range 499 (Byte 611)

If Byte 106 = 3 (Both), there are 250 range bytes per channel. The range bytes alternate from channel to channel.

i.e.

Stbd[0] = Byte 112

Port[0] = Byte 113

Stbd[1] = Byte 114

Port[1] = Byte 115

.

Stbd[249] = Byte 610

Port[249] = Byte 611

The sonar data intensity level varies from 0 to 127.

Byte 612 **Termination Byte** - always 0xFC

MODEL 881 SPORTSCAN DIGITAL SIDESCAN SONAR

SERIAL INTERFACE SPECIFICATION (v7.00)

OVERVIEW

The Model 881 Sportscan Digital Sidescan Sonar communicates over a 3-wire RS-232 serial data transmission line. To interrogate the Sportscan and receive echo data, a Switch Data Command string is sent via a serial command program at a baud rate of **115200 bps**, **No Parity, 8 Data Bits and 1 Stop Bit**. When the Switch Data command is accepted, the Sportscan transmits, receives and sends its return data back to the commanding program.

SWITCH DATA COMMAND

The Sportscan accepts up to 27 bytes of switch data from the serial interface and must see the switch data header (2 bytes: **0xFE** and **0x44** HEX) in order to process the switches. The Sportscan will stop accepting switch data when it sees the termination byte (**0xFD** HEX), or 28 bytes (whichever comes first). The termination byte must be present for the Sportscan to process the switches.

Note: the Termination Byte is the only switch value allowed to have a value of 0xFD. All other switches should be set higher or lower than 0xFD (253 Decimal) so they are not interpreted as a termination byte!

Byte #	Description							
0 – 7	0xFE	0x44	Head ID	Range	Reserved 0	Hold	Master/ Slave	Sidescan Mode
8 – 15	Start Gain	LOGF	Absorption	Port Gain Balance	Stbd Gain Balance	Reserved 0	Pulse Length	Reserved 0
16 – 23	Reserved 0	Reserved 0	Reserved 0	Data Points	Data Bits	Up Baud	Reserved 0	Reserved 0
24 – 26	Switch Delay	Freq- uency	Term. 0xFD					

Table 1 Model 881 Sportscan Digital Sidescan Sonar Switch Data Command

SWITCH DATA COMMAND (con't)

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' (hexadecimal) prefix.

Byte 0	Switch Data Header (1st Byte) Always 0xFE (254 decimal)
Byte 1	Switch Data Header (2nd Byte) Always 0x44 (68 decimal)
Byte 2	Head ID 0x10 for Model 881-000-XXX Sportscan Digital Sidescan Sonar
Byte 3	Range 5 ranges available: 15 = 15m 30 = 30m 60 = 60m 90 = 90m 120 = 120m - units must be meters
Byte 4	Reserved Always 0
Byte 5	Hold Bit 0 - 1 = Hold (or pause) operation, 0 = Resume Bit 1 - 0 Bit 2 - 0 Bit 3 - 0 Bit 4 - 0 Bit 5 - 0 Bit 6 - 0 Bit 7 - 0

SWITCH DATA COMMAND (con't)

Byte 6	Master / Slave The Sportscan can be operated as a master or as a slave. The default mode on power-up is Slave mode (Bit 6 = 1). Slave mode allows the user to command the Sportscan to transmit and send its return data at any given time. Bit 0 - 1 = Transmit if Bit 6 = 1 (Slave Mode) Bit 1 - 1 = Send Data if Bit 6 = 1 (Slave Mode) Bit 2 - 0 Bit 3 - 0 Bit 4 - 0 Bit 5 - 0 Bit 6 - 0 = Master, 1 = Slave Bit 7 - 0 - use 0x43 for Slave Mode
Byte 7	Sidescan Mode 3 modes are available: 1 = Port channel only 2 = Starboard channel only 3 = Both channels
Byte 8	Start Gain 0 to 40dB in 1dB increments
Byte 9	LOGF This value should always = 1
Byte 10	Absorption 10 = Low Frequency 20 = High Frequency
Byte 11	Port Gain Balance 71 to 141 Percent 71 = -3dB, $100 * [10^{(-3dB/20dB)}] = 71$ 100 = 0dB, $100 * [10^{(0dB/20dB)}] = 100$ 141 = +3dB, $100 * [10^{(3dB/20dB)}] = 141$

SWITCH DATA COMMAND (con't)

Byte 12	Stbd Gain Balance 71 to 141 Percent $71 = -3\text{dB}, \quad 100 * [10^{(-3\text{dB}/20\text{dB})}] = 71$ $100 = 0\text{dB}, \quad 100 * [10^{(0\text{dB}/20\text{dB})}] = 100$ $141 = +3\text{dB}, \quad 100 * [10^{(3\text{dB}/20\text{dB})}] = 141$
Byte 13	Reserved Always 0
Byte 14	Pulse Length Length of acoustic transmit pulse. 0 to 255 μsec in 1 μsec increments Do not use a value of 253! - 100 μsec is a typical value
Byte 15	Reserved Always 0
Byte 16	Reserved Always 0
Byte 17	Reserved Always 0
Byte 18	Reserved Always 0
Byte 19	Data Points 40 - 400 data points are returned by the Sportscan The return data will have an ASCII 'IGX' header. 50 - 500 data points are returned by the Sportscan The return data will have an ASCII 'IHX' header.
Byte 20	Data Bits Resolution (number of data bits) of the returned echo data 8 - Data width = 8 Bits, 1 data point per byte

SWITCH DATA COMMAND (con't)

Byte 21	Up Baud The Sportscan receives switch data at 115200 baud, but can transmit its return data at various baud rates. The Up Baud value sets the Sportscan to transmit at a new baud rate. The default Up Baud value on power-up is 115200 baud. 0x0B - 9600 baud 0x03 - 14400 baud 0x0C - 19200 baud 0x04 - 28800 baud 0x02 - 38400 baud 0x05 - 57600 baud 0x06 - 115200 baud
Byte 22	Reserved Always 0
Byte 23	Reserved Always 0
Byte 24	Switch Delay The Sportscan can be commanded to pause (from 0 to 510 msec) before sending its return data to allow the commanding program enough time to setup for serial reception of the return data. 0 to 255 in 2 msec increments Do not use a value of 253!
Byte 25	Operating Frequency 0 = Low Frequency 1 = High Frequency
Byte 26	Termination Byte The Sportscan will stop looking for Switch Data when it sees this byte. Always 0xFD (253 decimal)

SPORTSCAN RETURN DATA

Every ping, the Sportscan returns a 12 Byte header, up to 500 points of echo data (depending on the Switch Data command that was sent) and a terminating byte value of 0xFC. The **total number of bytes (N)** returned will be 413 or 513.

Byte #	Description					
0 to 5	ASCII T	ASCII 'G' or 'H'	ASCII 'X'	Head ID	Serial Status	Type
6 to 11	Channel	Range	Reserved 0	Reserved 0	Data Bytes	Data Bytes
12 to (N-2)	Echo Data 400 or 500 Data Bytes					
N-1	Term. 0xFC					

Table 2 Model 881 Sportscan Digital Sidescan Sonar Return Data

BYTE DESCRIPTIONS

Note: All Byte values are shown in decimal unless noted with a '0x' prefix.
N = total number of return bytes

Byte 0 - 2 **Imagenex Return Data Header**

ASCII 'IGX'

T = 0x49, 'G' = 0x47, 'X' = 0x58

In response to a Switch Data Command with Data Points = 40
8 Data Bits: N = 413 (400 Points)

ASCII 'IHX'

T = 0x49, 'H' = 0x48, 'X' = 0x58

In response to a Switch Data Command with Data Points = 50
8 Data Bits: N = 513 (500 Points)

Byte 3 **Head ID**

0x10 for Model 881-000-XXX Sportscan Digital Sidescan Sonar

SPORTSCAN RETURN DATA (con't)

Byte 4 **Serial Status**
Bit 0 - 1 = V7 SportScan (IHX mode available)
Bit 1 - 0
Bit 2 - 0
Bit 3 - 0
Bit 4 - 0
Bit 5 - 0
Bit 6 - 1 = Switches Accepted
Bit 7 - 1 = Character Overrun

Byte 5 **SportScan Type**
0 = Single Frequency
1 = Dual Frequency

Byte 6 **Sidescan Channel**
1 = Starboard
2 = Port
3 = Both

Byte 7 **Range**
Sportscan operating range: 15, 30, 60, 90 or 120 Meters

Byte 8 **Reserved**
Always 0

Byte 9 **Reserved**
Always 0

Byte 10 - 11 **Data Bytes**
Number of Echo Data Bytes returned by the SportScan head
Data Bytes (LO), Data Bytes (HI)

Byte 10								Byte 11								
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
0	Data Bytes (LO)							0	Data Bytes (HI)							L

Data Bytes High Byte = (Byte 11 & 0x7E)>>1

Data Bytes Low Byte = [((Byte 11 & 0x01)<<7) | (Byte 10 & 0x7F)]

Data Bytes = (Data Bytes High Byte<<8) | Data Bytes Low Byte

SPORTSCAN RETURN DATA (con't)

Byte 12 **Start of Echo Data**
(N-13) Bytes of data

Example is for **IHX** mode

If Sidescan Channel (Byte 6) = 1 or 2 (Stbd or Port Channel Only),
there are 500 points/channel:

1st Range point = Byte 12
2nd Range point = Byte 13
3rd Range point = Byte 14
4th Range point = Byte 15, etc. ...

If Sidescan Channel (Byte 6) = 3 (Both Channels),
there are 250 points/channel:

1st Range point (Stbd) = Byte 12
1st Range point (Port) = Byte 13
2nd Range point (Stbd) = Byte 14
2nd Range point (Port) = Byte 15, etc. ...

Byte (N-2) **End of Echo Data**

Byte (N-1) **Termination Byte**
0xFC

SONAR THEORY AND APPLICATIONS

EXCERPT FROM IMAGENEX MODEL 855

COLOR IMAGING SONAR USER'S MANUAL

**IMAGENEX TECHNOLOGY CORP.
#209 - 1875 BROADWAY ST.
PORT COQUITLAM, B.C. V3C 4Z1
CANADA**

**TEL: (604) 944-8248
FAX: (604) 944-8249**

ABOUT YOUR SONAR

TERMINOLOGY:

The following is an explanation of the basic terms used by Imagenex to describe their sonar techniques.

Color: The different colors used to represent the varying echo return strengths.

Echo: The reflected sound wave

Echo Return: The time required for the echo to return to the source of the sound

Sonar: The principle used to measure the distance between a source and a reflector (target) based on the echo return time

Target: The object that you wish to obtain information about.

IMAGING:

Fan shaped beam

Scans surfaces at shallow angles, usually through a horizontal angle

Displays color images or pictures

Complete echo strength information for each point

Primarily for visual interpretation

In **Imaging** a fan-shaped sonar beam scans a given area, by either rotating or moving in a straight line, through a series of small steps, (see **Figure 1**). The beam's movement through the water generates points that form a sonar image of the given area. The different colored points, representing the time (or slant range) of each echo return, plot a line on a video display screen. The image, consisting of the different colored lines, depicts the various echo return strengths. The following characteristics are necessary to produce a visual or video image of the sonar image:

- the angle through which the beam is moved is small
- the fan-shaped beam has a narrow angle
- the transmitted pulse is short
- the echo return information is accurately treated

These visual images provide the viewer with enough data to draw conclusions about the environment being scanned. The operator should be able to recognize sizes, shapes and surface reflecting characteristics of the chosen target. The primary purpose of the imaging sonar is as a viewing tool.

PROFILING:

Narrow pencil shaped beams

Scans surfaces at a steep angle usually on a vertical plane

Displays individual points or lines

Accurately cross-sections a surface

Echo strength for each point higher than a set threshold

Digitizes a data set for interfacing with external devices

Data set is small enough to be manipulated in a small computer

Primarily a measurement tool

In **Profiling** a narrow pencil-shaped sonar beam scans across the surface of a given area generating a single profile line on the display monitor, (see **Figure 2**). This line, consisting of a few thousand points, accurately describes the cross-section of the targeted area. A key to the

Profiling process is the selection of the echo returns for plotting. The sonar selects the echo returns, typically one or two returns for each "shot", based on a given criterion for the echo return strength and the minimum profiling range. The information gathered from the selection criteria forms a data set containing the range and bearing figures. An external device, such as a personal computer or data logger, accesses the data set through an RS-232 interface with the sonar.

The profile data is useful for making pen plots of bottom profiles, trench profiles, internal and external pipeline profiles. The primary purpose of the profiling sonar is as a quantitative measuring tool.

USING AN IMAGING SONAR ON AN ROV

The imaging sonar is a useful substitute for a positioning system on an ROV. Without an imaging sonar, an ROV relies on traveling underwater to bring new targets into view. With an imaging sonar, instead of traveling it is more useful to spend some time with the vehicle sitting on the bottom while the sonar scans the surrounding area. Scanning a large area takes only a short time, and the vehicle pilot can quickly assess the nature of the surrounding area. The ability to "see" a long distance underwater allows the pilot to use natural or man-made features and targets as position references.

The combination of an imaging sonar and an ROV leads to fast and effective training in sonar interpretation. If the ROV pilot is searching for a particular object, recognition can take place directly from the sonar image. In other cases a number of potential targets may be seen. A pilot can sharpen his sonar interpretation skills by viewing these targets with the vehicle's video camera and correctly identify them.

INTERPRETATION OF SONAR IMAGES

In many cases the sonar image of a target will closely resemble an optical image of the same object. In other cases, the sonar image may be difficult to interpret and quite unlike the expected optical image. The scanning process used to create a sonar image is different from the process used by the human eye or a camera to produce optical images. A sonar image will always have less resolution than an optical image, due to the nature of the ultrasonic signals used to generate it.

Generally, rough objects reflect sound well in many directions and are therefore good sonar targets. Smooth angular surfaces may give a very strong reflection in one particular direction, but almost none at all in other directions. Some objects, such as smooth plane surfaces, may be difficult to see with a sonar. They can act as a perfect mirror (so called specular reflectors), reflecting the sonar pulse off in unexpected directions, never to return. This happens to people visually, when they see an object reflected in a window. The human eye deals with such reflections daily but it is surprising to see the same thing occur with a sonar image. As with normal vision, it is often useful to scan targets from different positions, to help identify them. A target which is unrecognizable from one direction may be quite easy to identify from another.

It is very important to note that the ranges shown to the targets on the sonar image are "slant" ranges. Usually the relative elevations of the targets are not known, only the range from the transducer. This means that two targets, which are displayed in the same location on the screen may be at different elevations. For example, you might see a target on the bottom, and a target

floating on the surface in the same place. By analyzing the shadows you can estimate the height of objects above the bottom. An example of this calculation is shown in **Figure 4**.

The diagrams following this chapter are examples of the sonar scanning process. Studying the diagrams will help you to better understand the images that you see. A basic knowledge of this process will help users to interpret what otherwise might be confusing images.

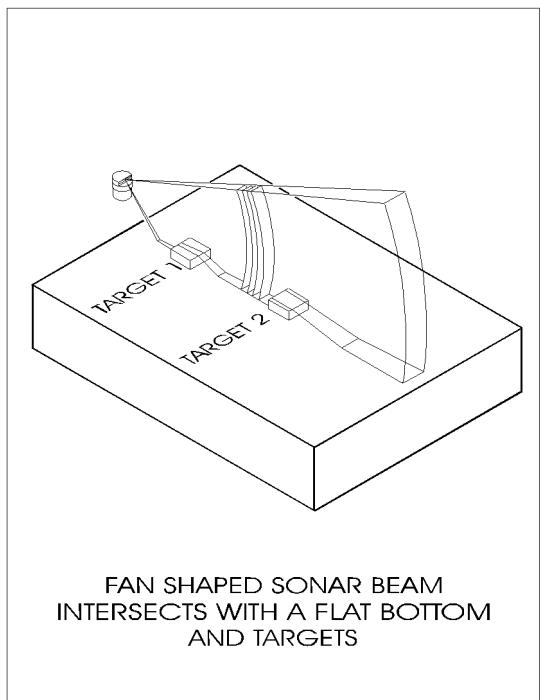
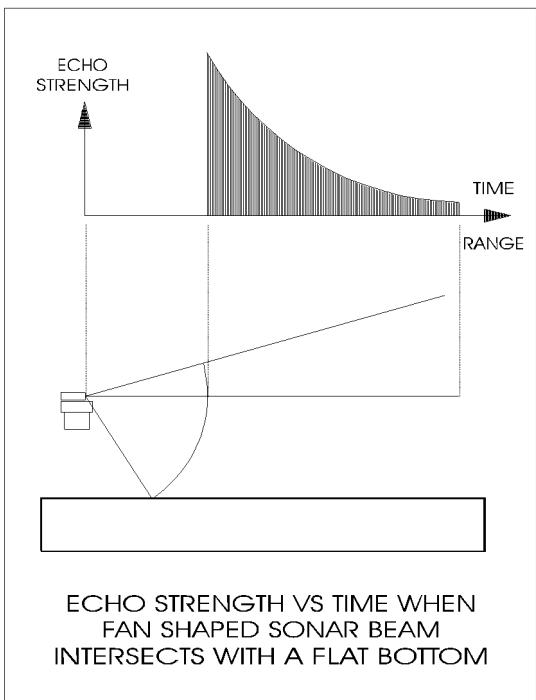
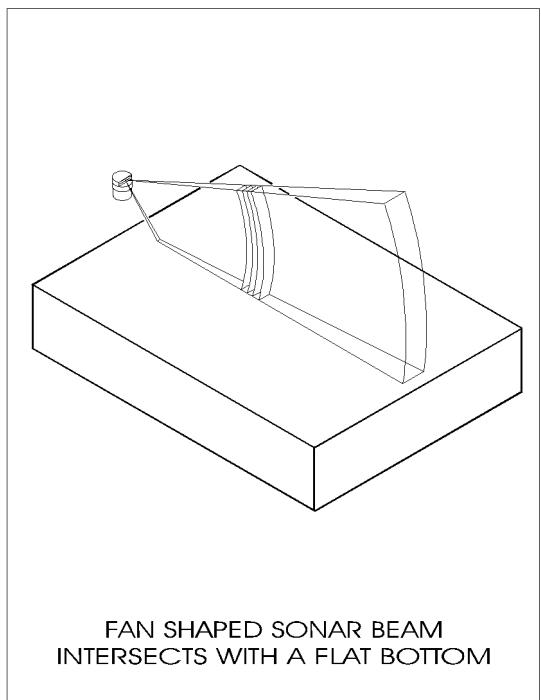
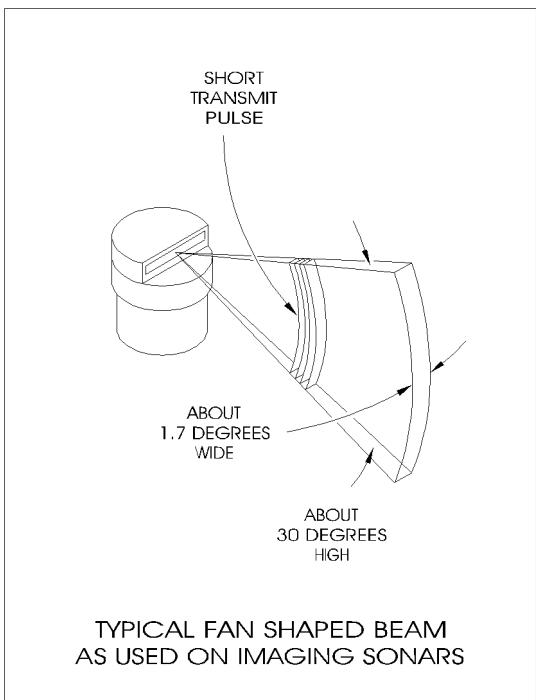


FIGURE 1

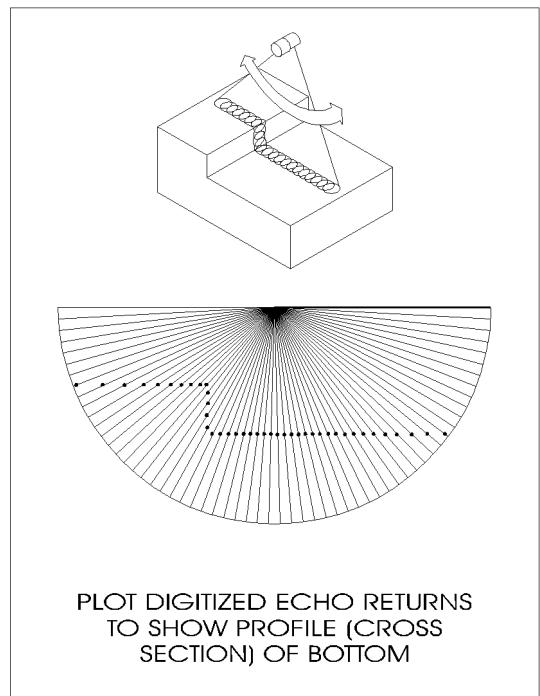
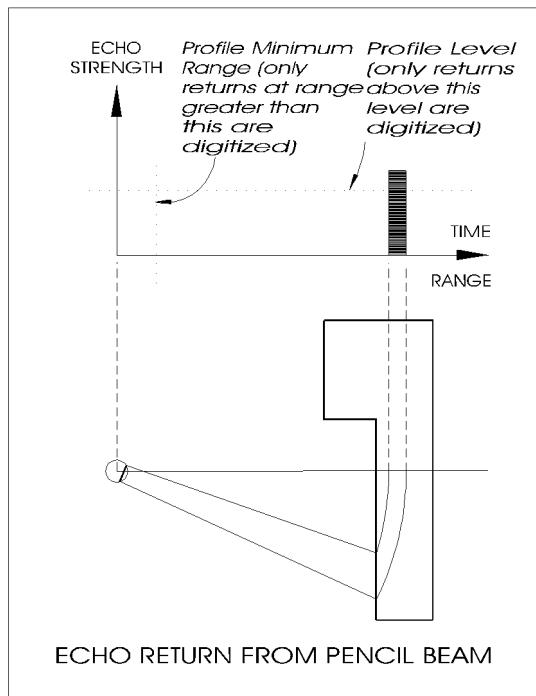
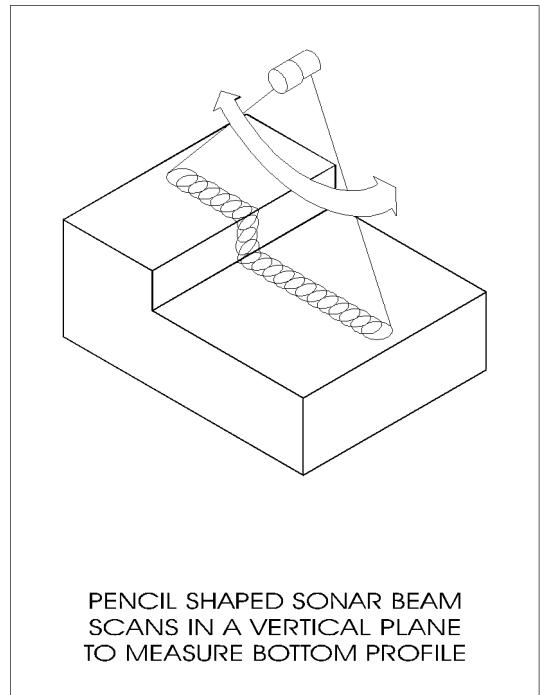
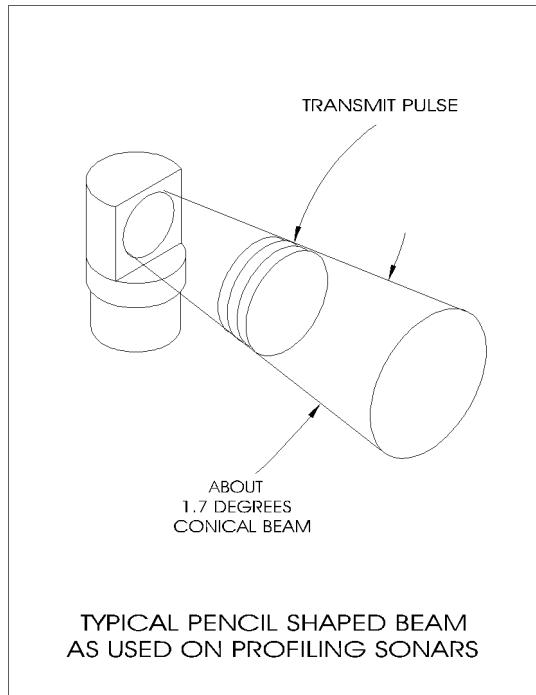


FIGURE 2

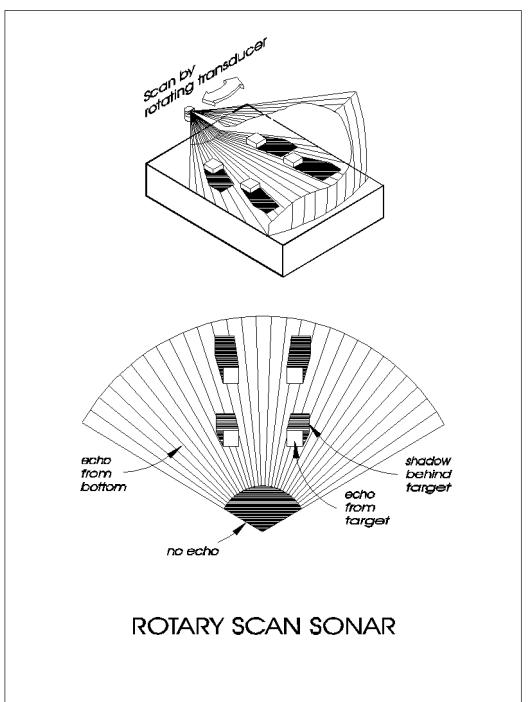
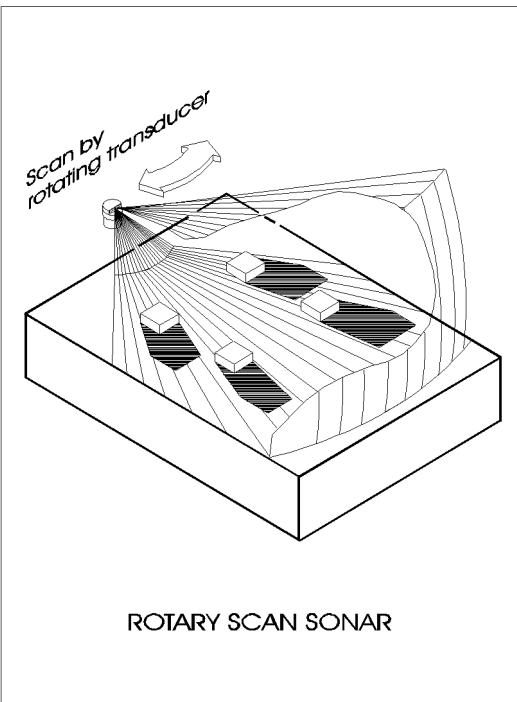
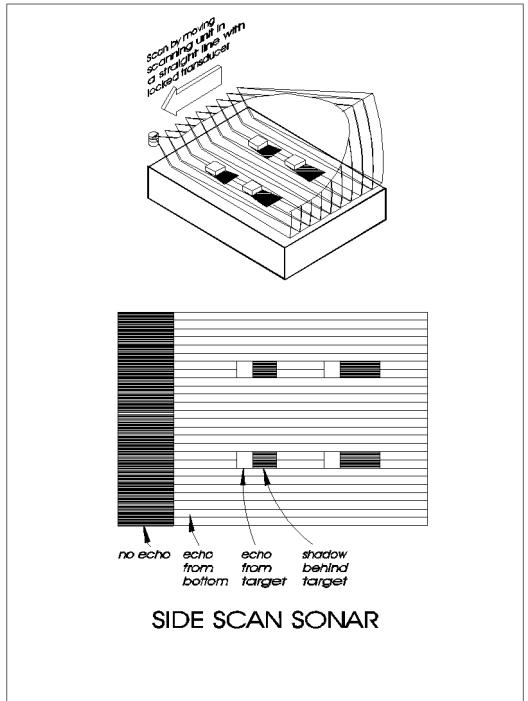
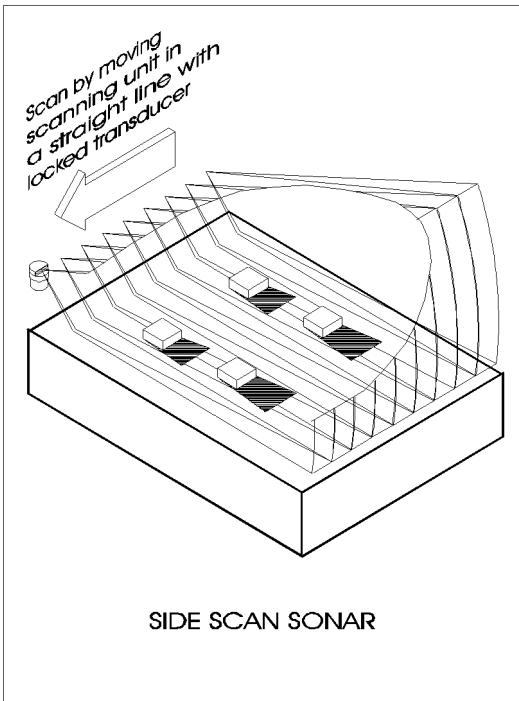


FIGURE 3

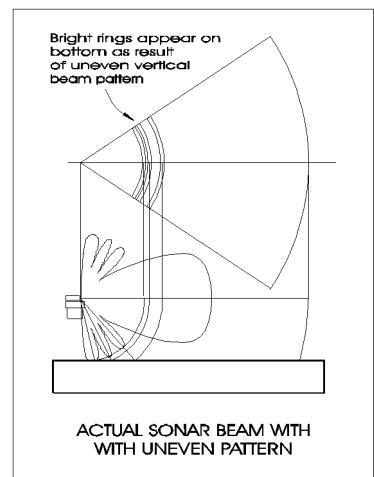
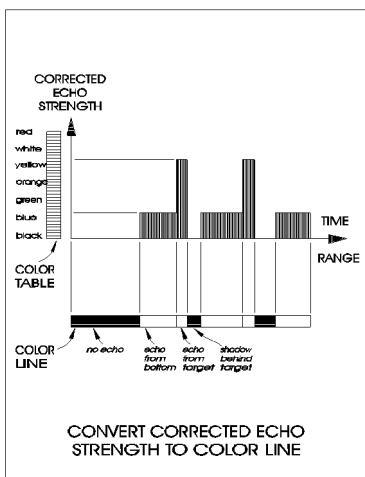
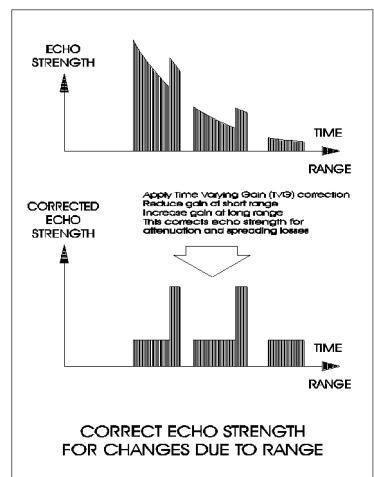
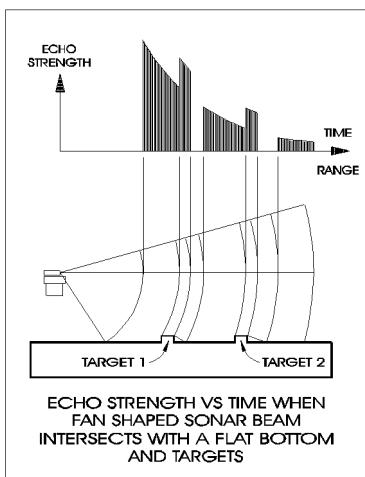
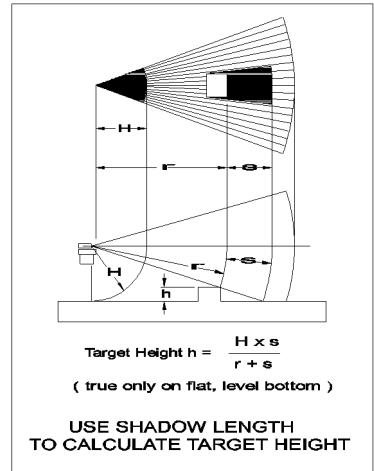
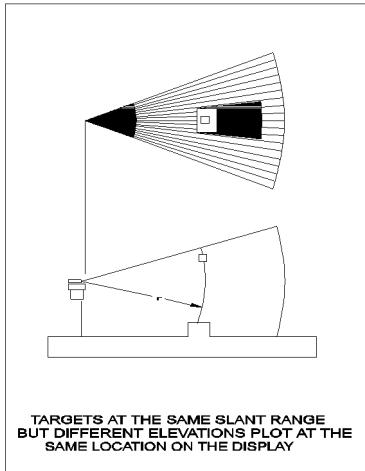


FIGURE 4